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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/188,190 | 11/10/1998 | KATSUNORI KANEKO | 1472-177P | 4015 |

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| EXAMINER | |
|---|---|
| NGUYEN, TU MINH | |
| **ART UNIT** | **PAPER NUMBER** |
| 3748 | |

DATE MAILED: 09/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/188,190 | KANEKO ET AL. | |
| | Examiner | Art Unit | |
| | Tu M. Nguyen | 3748 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on *12 August 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *3-21,23 and 24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3-21,23 and 24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 October 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

1. An Applicant's Amendment filed on August 12, 2004 has been entered. Claims 1 and 22 have been canceled; claims 3, 5, 8, 10, and 15-18 have been amended; and claim 24 has been added. Overall, claims 3-21, 23, and 24 are pending in this application.

### *Drawings*

2. The formal drawing of Figure 5 filed on October 2, 2002 has been approved for entry.

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 3-21, 23, and 24 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In the amended base claim 23 and newly added dependent claim 24, applicant claims that a $SO_x$ release control is performed every second interval independent from and longer that the first interval (of a $NO_x$ release control). Moreover, applicant further states that the $SO_x$ release control and the $NO_x$ release control in the pending application take place independently (bottom

of page 12 of Applicant's Amendment). This is not shown or disclosed in the applicant's disclosure. In Figure 8 and the corresponding text, in step S30, if a $NO_x$ conversion efficiency is less than threshold value "a", a $SO_x$ release control is performed, where a very high temperature (600°C or higher) and fuel rich atmosphere exhaust gas is produced around the $NO_x$ catalyst. Since applicant fails to disclose that a $NO_x$ release control must be performed before this $SO_x$ release control (emphasis added), it is at least obvious to those with ordinary skill in the art that the $NO_x$ trapped in the $NO_x$ catalyst must also be released during this SOx release control since the purged temperature for $NO_x$ is much less than 600°C in the same fuel rich environment. Therefore, it is the examiner's position that based on applicant's disclosure, the $SO_x$ release control and the $NO_x$ release control in the pending application do not take place independently; and as such, the pending claims 23 and 24 contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

### *Claim Rejections - 35 USC § 102*

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office Action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.
>
> The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

6. Claims 10-15, 17, and 23, as best understood, are rejected under 35 U.S.C. 102(e) as being anticipated by Murachi et al. (U.S. Patent 5,746,989).

Re claim 23, as shown in Figure 1, Murachi et al. disclose an exhaust gas purifying apparatus of an internal combustion engine, comprising:

- a light-off catalyst (5) provided in an exhaust passage and having an $O_2$ storage capability such that the light-off catalyst passes, there through, at least CO in an exhaust gas to a downstream side of the light-off catalyst when the internal combustion engine is operating under a condition where the oxygen concentration of the exhaust gas is reduced (see line 66 of column 3 to line 8 of column 4) (light-off catalyst (5) has limited oxygen storage capability because when the engine air-fuel ratio is switched to fuel rich, much of HC and CO in the exhaust gas pass through the light-off catalyst (5) unoxidized (lines 29-38 of column 6));

- exhaust gas purifying means (9) provided in the exhaust passage at a downstream position of and in series with the light-off catalyst, the exhaust gas purifying means having a $NO_x$ catalyst (alkaline earth metals such as barium) for adsorbing $NO_x$ in the exhaust gas when an air-fuel ratio of the exhaust gas is lean and releasing the adsorbed $NO_x$ when the oxygen concentration of the exhaust gas is reduced, the exhaust gas purifying means further having a three-way catalyst (platinum) that reacts with the released $NO_x$ (line 50 of column 4 to line 36 of column 5); and

- control means (20, 4) for repeatedly releasing $NO_x$ adsorbed by the $NO_x$ catalyst every first interval (2 minutes) and repeatedly releasing $SO_x$ adsorbed by the $NO_x$ catalyst every second

interval (60 minutes) independent from and longer than the first interval (see Figure 5 and lines 43-64 of column 8).

Re claims 10 and 11, the single catalyst of the exhaust gas purifying means (9) in the apparatus of Murachi et al. includes a function of the three-way catalyst.

Re claim 12, the light-off catalyst (5) in the apparatus of Murachi et al. includes a single catalyst that functions as the three-way catalyst (line 66 of column 3 to line 16 of column 4).

Re claim 13, the exhaust gas purifying means (9) in the apparatus of Murachi et al. further functions also as the $NO_x$ catalyst.

Re claim 14, the light-off catalyst (5) in the apparatus of Murachi et al. also functions as a $SO_x$ catalyst to oxidize and convert $SO_2$ in the exhaust gas to a sulfate which can be absorbed by the exhaust gas purifying means (lines 22-26 of column 8).

Re claim 15, in the apparatus of Murachi et al., the condition where the oxygen concentration of the exhaust gas is reduced includes a fuel rich operating condition (lines 29-45 of column 6).

Re claim 17, in the apparatus of Murachi et al., the light-off catalyst (5) is provided in the exhaust passage immediately downstream of the internal combustion engine.

### *Claim Rejections - 35 USC § 103*

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 3 and 4, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. as applied to claim 23 above, in view of design choice.

The apparatus of Murachi et al. discloses the invention as cited above, however, fails to disclose that an amount of oxygen absorbed on the light-off catalyst is not greater than about 150 cc per one-liter volume of the catalyst when measured by an oxygen pulse method and that an oxygen component stored in the light-off catalyst is not greater than about 25 gr per one-liter volume of the catalyst.

One having ordinary skill in the art of exhaust emission control would have recognized that the specification of the maximum volumetric or weighted amount of oxygen absorbed in a light-off catalyst would be a function of many variables such as the size of the light-off catalyst, engine size, engine operating conditions (load, speed, etc), air and fuel properties, capacity and size of a main catalyst, etc. Moreover, there is nothing in the record which establishes that the claimed maximum volumetric or weighted amount of oxygen absorbed in a light-off catalyst presents a novel of unexpected result (See *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975)).

9. Claims 5, 16, and 18-21, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. as applied to claim 23 above.

Re claims 5, 16, and 18, the apparatus of Murachi et al. discloses the invention as cited above, however, fails to disclose that the three-way catalyst of the exhaust gas purifying means (9) has an oxygen storage value greater than an oxygen storage value of the light-off catalyst (5);

and that the light-off catalyst mainly purifies HC in an exhaust gas emitted from the engine in a cold state.

It is obvious to those with ordinary skill in the art that the light-off catalyst (5) in Murachi et al. is a relatively small catalyst with low oxygen storage capability as compared with the exhaust gas purifying means (9) and is located closer to an outlet of the engine where the exhaust gas temperature is still relatively high. In this way, the light-off catalyst (5) reaches an activation temperature at an earlier time in order to purify HC emitting from the engine in a cold state.

Re claims 19 and 20, in the apparatus of Murachi et al., the light-off catalyst (5) includes a three-way catalyst having a function of an oxidizing catalyst (line 66 of column 3 to line 16 of column 4).

Re claim 21, in the apparatus of Murachi et al., the control means sets the air-fuel ratio leaner as compared to an air-fuel ratio required to release the adsorbed $NO_x$ from the $NO_x$ catalyst is used in conjunction with a three-way catalyst in which the oxygen storage capability is not reduced (the exhaust gas purifying means (9) also includes platinum (line 54 of column 4) as a three-way catalyst which has a non-reduced oxygen storage capacity).

10. Claims 6 and 7, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of official notice as applied to claim 5 above, and further in view of design choice.

The apparatus of Murachi et al. discloses the invention as cited above, however, fails to disclose that an amount of oxygen absorbed on the three-way catalyst of the exhaust gas purifying means is not greater than about 150 cc per one-liter volume of the catalyst when measured by an oxygen pulse method and that an oxygen component stored in the three-way

catalyst of the exhaust gas purifying means is not greater than about 25 gr per one-liter volume of the catalyst.

One having ordinary skill in the art of exhaust emission control would have recognized that the specification of the maximum volumetric or weighted amount of oxygen absorbed in the exhaust gas purifying means would be a function of many variables such as the size of the exhaust gas purifying means, engine size, engine operating conditions (load, speed, etc), air and fuel properties, capacity and size of a main catalyst, etc. Moreover, there is nothing in the record which establishes that the claimed maximum volumetric or weighted amount of oxygen absorbed in the exhaust gas purifying means presents a novel of unexpected result (See *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975)).

11. Claims 8-9, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. as applied to claim 23 above.

Re claim 8, the apparatus of Murachi et al. discloses the invention as cited above, however, fails to disclose that their engine is a spark ignition type four-cycle engine that operates on the four-stroke cycle consisting of a suction stroke, compression stroke, combustion/expansion stroke, and exhaust stroke.

Murachi et al. disclose the claimed invention except for applying the invention to a spark ignition type four-cycle engine. It would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the invention of Murachi et al. to a spark ignition type engine, since the recitation of such amounts to an intended use statement. Note that both "spark-ignition engine" and "diesel engine" generate exhaust gases containing harmful emissions of HC, $NO_x$, soot, CO, etc, that require purification before the gases can be released to the

atmosphere; and the mere selection of the purification system of Murachi et al. for use in a spark ignition engine would be well within the level of ordinary skill in the art.

Re claim 9, in the apparatus of Murachi et al., the internal combustion engine is an in-cylinder injection type engine in which fuel is directly injected into a combustion chamber.

12. Claim 24, as best understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. as applied to claim 23 above, in view of Hepburn (U.S. Patent 5,743,084).

The apparatus of Murachi et al. further comprises control means for recovering the $NO_x$ catalyst by reducing the oxygen concentration in the exhaust gas such that the CO that has passed through the light-off catalyst is introduced to the $NO_x$ catalyst when a $NO_x$ conversion efficiency of the $NO_x$ catalyst is decreased and maintaining the reduced oxygen concentration until absorbed $NO_x$ in the $NO_x$ catalyst is released.

Murachi et al., however, fail to disclose that the control means further calculates the $NO_x$ conversion efficiency after the recovery, and regenerating the $NO_x$ catalyst to release $SO_x$ only when the $NO_x$ conversion efficiency, calculated after the recovery, is less than a threshold value.

As illustrated in Figure 1 and 7, Hepburn teaches a method to remove $SO_x$ from a $NO_x$ trap (32), in which a lean time (T1) between two adjacent rich spikes is reduced when a $NO_x$ storage or conversion efficiency is lower than a threshold value (step 112 with YES answer and step 114). A $SO_x$ purge is performed only after a $NO_x$ purge is performed and when the lean time is less than a predetermined value (step 90 with NO answer and step 120). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the method taught by Hepburn in the apparatus of Murachi et al., since the use

thereof would have maintained high $NO_x$ purification efficiency by timely purging $SO_x$ trapped in the $NO_x$ purifying catalyst.

***Response to Arguments***

13. Applicant's arguments with respect to the references applied in the previous Office Action have been fully considered but they are not persuasive.

Re claim 23, in response to applicant's argument that Murachi et al. fail to disclose "a control means for repeatedly releasing $NO_x$ adsorbed by the $NO_x$ catalyst every first interval and repeatedly releasing $SO_x$ adsorbed by the $NO_x$ catalyst every second interval independent from and longer than the first interval" (pages 12-13 of Applicant's Amendment), the examiner respectfully disagrees.

As shown in Figure 5 and indicated on lines 43-64 of column 8, Murachi et al. have to wait 60 minutes from the last $SO_x$ purge in order to begin purging $SO_x$ again. During this 60 minutes of waiting, the $NO_x$ purge is performed as many as 30 times because they only have to wait 2 minutes from the last $NO_x$ purge before repeating with the next $NO_x$ purge. Since 60 minutes is longer than 2 minutes, it is clear that Murachi et al. disclose "a control means for repeatedly releasing $NO_x$ adsorbed by the $NO_x$ catalyst every first interval and repeatedly releasing $SO_x$ adsorbed by the $NO_x$ catalyst every second interval longer than the first interval". And since the $SO_x$ is not purged during these 30 times of purging $NO_x$, the $SO_x$ release control and $NO_x$ release control in Murachi et al. are independent from each other. Or in other words, in Murachi et al., it is possible to release $NO_x$ even when the $SO_x$ release control is not taking place.

***Conclusion***

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Communication***

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (703) 308-2833 or (571) 272-4862 which is effective on November 22, 2004.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (703) 308-2623 or (571) 272-4859 which is effective on November 22, 2004. The fax phone number for this group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-1148.

Tu M. Nguyen

TMN

September 16, 2004

Tu M. Nguyen

Patent Examiner

Art Unit 3748